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REPORT

CD NO.

COUNTRY	Bulgaria	DATE OF INFORMATION	1953
SUBJECT	Economic - Water power, irrigation, navigation, coal, metals Transportation - Water Geographic - Distances between cities, terrain		
HOW PUBLISHED	Monthly periodical	DATE DIST.	5 May 1954
WHERE PUBLISHED	Sofia	NO. OF PAGES	9
DATE PUBLISHED	May 1953		
LANGUAGE	Bulgarian	SUPPLEMENT TO REPORT NO.	

THIS IS UNEVALUATED INFORMATION

SOURCE As indicated

PLAN FOR EXPLOITATION OF WATER RESOURCES IN SOUTHERN BULGARIA

/Numbers in parentheses refer to appended sources./

Water power and irrigation problems in the Thracian plains of southern Bulgaria arise from the growing demands of the economy of this region.

Southern Bulgaria's fertile and level lands (the areas of the Maritsa and Tundzha rivers and Burgas Okrug) are suitable for mechanized agriculture, and its warm climate is favorable for growing almost all varieties of fruit, grains, oil-yielding plants, fiber-yielding plants, and vegetables. Almost every year, however, seasonal variations in the amounts of river water and frequent long spells of drought reduce the harvests from the rich fields. Studies of the climatic conditions in southern Bulgaria during the past 25 years (1928-1952) indicate that only 7 years had close to normal precipitation, favorable to agriculture, while the remaining 18 years had insufficient precipitation for agricultural needs.

A survey of the water problem in southern Bulgaria reveals the following:

1. Irrigation of the Pazardzhik and Plovdiv plains will be inadequate until reservoirs are built along the rivers.

2. In the past, the rich and level areas of Stara Zagora, Nova Zagora, Yambol, and Burgas okoliyas were not irrigated because the authorities failed to take measures to preserve river waters.

3. Although the soil increases gradually in richness from Pazardzhik eastward to the Black Sea, precipitation decreases, rivers become dry for longer periods during the year, and consequently the drought becomes longer and more disastrous for agriculture.

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4. The rivers of the Rhodope area, including the Gorna Maritsa River, have high waterfalls and therefore are suitable for hydroelectric power production. The rivers in the eastern section of southern Bulgaria dry up during the summers and are not suitable for the development of large hydroelectric power stations.

5. The subterranean streams of the entire level plain from Pazardzhik to the Black Sea, with the exception of a narrow strip along the Tundzha River, decrease gradually in quantity from the west to the east.

6. The temperature in southern Bulgaria during the vegetation period (April - November) is uniform except in the east, where it is slightly higher and averages a total temperature of 4135 degrees centigrade for the 8-month period. The average daily temperature is 17.2 degrees centigrade in Burgas. The average yearly freezing period on the rivers in the level part of this region between Pazardzhik and Burgas lasts only 20-25 days.

One of the most feasible locations for hydroelectric power stations in southern Bulgaria is the Gorna Maritsa River Valley with its Rhodope tributaries.

The following hydroelectric power complexes are projected /or already under construction/ in the Rila and Rhodope mountains: the "Gorna Maritsa" and "Sestrimo" VETs (hydroelectric power stations), including the "Belmeken" Dam; the "Vasil Kolarov-Batak-Debrashtitsa" Waterway, including the "Kolarov" and "Batak" dams; the "Dospat" and "Vucha" VETs, including the "Dospat" and "Mikhalkovo" dams; and the "Arda" VETs, including the "Kurdzhali" and "Studen Kladenets" dams. Dams designed chiefly for irrigation will be located on the Topolnitsa, Lada Yana, Peschanik, Strema, Tundzha, and other small rivers. The projected reservoirs on the upper parts of these rivers are expected to facilitate the production of over 3.6 billion kilowatt-hours of electric power /per year/ and the irrigation of millions of decares of fertile soil.

The level region from Belovo to the Black Sea has over 9 million decares of irrigable land, including 6 million decares with a 3 percent slope, 2 million decares with a 3-5 percent slope, and over one million decare with more than a 5 percent slope.

Since many dams are built at high elevations, without reservoirs near the fields to be irrigated, the hydroelectric power stations must operate according to the irrigation schedule, or the water will be lost for irrigation purposes during the summer. This is the case with the power stations of the "Vasil Kolarov-Batak-Debrashtitsa" Waterway, with the "Vucha" VETs, and partly with the "Georgi Dimitrov" and the "Gyurlya" VETs /which operate during the nonirrigation season/. Small dams have not been built at low elevations because of the fear that they would be covered with plants or that too much agricultural land would be flooded. However, experience has shown that one decare of water area used as a fishery is always more profitable than one decare of agricultural land cultivated according to the general crop rotation plan.

Research for the past 15 years indicates that the average annual drainage of surface water into the rivers of southern Bulgaria is over 6 billion cubic meters of water. About 250 million cubic meters of water could be exploited from subterranean sources. If, for example, 80 percent of surface and subterranean water were used, it would provide annually an average of 560 millimeters of water for the 9 million decares of irrigable land. Research conducted thus far indicates that the average annual precipitation in southern Bulgaria /at present/ is about 450 millimeters or even less.

If a straight line were drawn from Stara Zagora to Dimitrovgrad and through the Arda River valley in the south, southern Bulgaria would be divided into two unequal and radically different sections.

The western section of southern Bulgaria has only 45 percent of the irrigable area, 75 percent of the surface water, and 60 percent of the subterranean water. Research indicates that the [projected] large electric power stations in the western section will produce 90 percent of southern Bulgaria's electric power.

The eastern section of southern Bulgaria has 55 percent of the irrigable area, 25 percent of the surface water, 40 percent of the subterranean water, and the capacity to produce only 10 percent of the electric power.

While the western section produces 80 percent of the lumber, 85 percent of the nonferrous metal ores, and only 3 percent of the coal [of southern Bulgaria?], the eastern section produces 80 percent of the oak beams, 90 percent of the ferrous metal ores, and 97 percent of the coal.

The western section has many suitable locations for the construction of reservoirs at high elevations to serve hydroelectric power stations, but is unsuitable for reservoirs at low elevations. The eastern section, on the other hand, lacks suitable locations for building large reservoirs at high elevations, but is suitable for large irrigation reservoirs at low elevations.

The Chaya, Eli-Dere, and Strema river valleys in the western section, with a total annual drainage of 600 million cubic meters of water, are not suitable for the construction of large reservoirs.

Northwest of Dimitrovgrad on the Stara reka River, near Durzhava, Chirpan Okoliya, construction of a dam with a capacity of 55-75 million cubic meters of water is feasible. A reservoir with a capacity of 800-900 million cubic meters of water could be built north of Karnobat [now Polyanovgrad].

Although 32 dams of various sizes are necessary for irrigating 3.5 million decares of land in the western section, only four dams, the "G. Dimitrov," the "Gyurlya," the "Zhrebchevo," and the "Karnobat," are needed to irrigate an area of an equal size in the eastern section. The problems of irrigation and of supplying electric power to the Thracian lowlands can be solved by combining the water projects of the Thracian lowlands into one system and by having the water flow from the western section to the eastern section and [then] to the Black Sea. The water requirements of the eastern section would be met by using the excess water of the western section.

Topography of this region favors the gravity flow of water from the Gorna Maritsa and the Tundzha basins to the Black Sea. A reservoir in the northern periphery of the Thracian plains and of the Karnobat swamps could collect and store 800-900 million cubic meters of water from the Maritsa and Tundzha rivers during the rainy winter and spring months and release it as needed during the summer for irrigation.

During the rainy season, the excess water from the upper streams of the Maritsa, Chaya, Sestrima, Topolnitsa, Luda Yana, Strema, and Vucha rivers could be collected and channeled into the "Karnobatsko blato" Dam through one main irrigation and navigation canal.

The water channeled to the "Karnobatsko blato" Dam, besides supplying the navigation canal during the entire year, could be used for producing electric power and for irrigating many low areas from hill 175 to hill 0 near the Black Sea.

The Tundzha River, which would irrigate the Thracian plains near Stara Zagora and Korten, would flow through the navigation canal to the "Karnobatsko blato" Dam when it is not used for irrigation. The water from the upper streams of the Luda Ticha River would flow through a relatively small dam between Shekhovo and Manolich to a hydroelectric power station between Mokren and Sungulare. The water flowing from the western section to the eastern section /of southern Bulgaria/ through a canal would connect the "Kuza-Durzhava" Dam with the "Karnobat" Dam.

Research indicates that the most feasible canal would be constructed at the lowest possible elevation above sea level, would connect the Maritsa River below Pazardzhik with the "Karnobat" Dam, would effect a gravity flow of 45-55 cubic meters of water per second, and would flow to the "Kuza Durzhava" Buffer and Equalizing Reservoir.

This projected trunk irrigation and navigation canal would begin at the Maritsa River near Plovdiv above Filipovo, would pass near Bolyarovo, Cherna gora, and south of Chirpan, and would flow into the "Kuza-Durzhava" Dam. From this dam the canal would pass near Svoboda, Mikhaylovo, Stara Zagora, and Nova Zagora, cross the water divide between the Azmak and the Tundzha rivers above Kovachite, merge with the Tundzha River above Slivenskite bani, and run to the "Karnobat" Dam. From the "Karnobat" Dam, the canal would pass near Aytos and Kameno and go through Lake Vaya to west Burgas, which is a harbor area. Between Plovdiv and the "Durzhava" /Kuza-Durzhava/ Dam, the canal would receive water from the Chaya, Vucha, Eli-Dere, Maritsa, Topolnitsa, Luda Yana, and Strema rivers.

After the water from the Arda River is used for irrigating Khaskovo Okoliya, 200-250 million cubic meters of it could be siphoned through a 3.5-kilometer pipeline into the "Durzhava" /Kuza-Durzhava/ Dam via Maritsa. At Svoboda, the water from the "Batak-Debrashtitsa" Waterway and from the "Vucha" and the Gorna Maritsa systems would drain into the "Karnobat" Dam.

The canal would also be supplied with water from the "Gyurlya-G. Dimitrov" and "Zhrebchevo" dams, from the Binkos, Tundzha, and Luda Ticha rivers, from the Manolich reservoir, and from several other rivers and small dams.

Canal sections could be added to the trunk canal. One of these could begin below Pazardzhik and join the trunk canal at Plovdiv. Another, instead of crossing the water divide between the Azmak and Tundzha rivers through a deep trench or a short tunnel, could bypass the elevation and follow the level area; thus, the canal would be lengthened by more than 70 kilometers and three or four more locks would be required, without any advantage being gained. The shorter canal route appears more feasible for irrigation, water power, and navigation. The projected trunk canal would have two branch extensions. One branch would extend from the "Durzhava" /Kuza-Durzhava/ Dam to Dimitrovgrad, continuing along the Maritsa River to Maritsa and along the lower part of the Rakitsitsa River to Maritsa-iztok, a new mining and industrial center. Another branch beginning at Burgas would continue southward along Lake Vaya, connect it with Lake Mandra at Poda, and terminate at Debelt.

Studies indicate that the most suitable navigable canal would be one which permitted two-way traffic of barges with a normal displacement of 600 tons and self-propelled vessels with a displacement of one thousand tons. Barges and vessels of this size could be towed with tugboats to Stalin, Shabla, Constanta, Izmail, and Odessa, and from there into the Danube, Dnepr, and Volga-Don river and canal network.

Such vessels would require a canal with the following minimum dimensions: Depth - 3 meters; width at bottom - 20 meters; width at surface - 32 meters.

The suggested canal would have 14-16 locks (built on rocky foundations) between "Karnobat" Dam and Burgas. Locks would also be constructed along the canal route from Svoboda to Dimitrovgrad and Maritsa-iztok.

The projected canal would run through the most densely populated places and the most economically advanced areas. As these populated places have a total population of over 500,000, enough manpower would be available for this project. The total amount of earth to be dug would be 40-42 million cubic meters.

The distances between the main centers along the canal route, which includes the "Kuza-Durzhava" and "Karnobat" dams, would be as follows:

	Kilometers
Plovdiv-Burgas	298
Plovdiv-Svoboda	72
Plovdiv-"Durzhava" [Kuza-Durzhava] Dam	64
Plovdiv-Dimitrovgrad	90
Plovdiv-Maritsa-iztok	130
Svoboda-Dimitrovgrad	32
Dimitrovgrad-Maritsa-iztok	40
Svoboda-Tundzha River	92
Tundzha River-"Karnobat" Dam	69
"Karnobat" Dam-Burgas	65
Svoboda-Burgas	226
Dimitrovgrad-Burgas	258
Stara Zagora-Burgas	198
Burgas-Debelt	22

The entire navigable route to Burgas harbor would be 392 kilometers, 62 of which would be on lakes and 330 on artificial canals.

After the canal water has been used for industrial and irrigation purposes in the western section, some of the excess water could be channeled into the "Karnobat" Dam in the east. This excess would be 1.2-1.3 billion cubic meters annually, of which about 300 million cubic meters would be used for irrigation, industrial needs, and communal needs, and to compensate for loss from filtration [seepage?]; and about 900 million cubic meters would be used by the "Karnobat" Dam. In addition, the "Karnobat" Dam would receive annually about 350 million cubic meters of water from the Binkos, Tundzha, and Luda Ticha rivers, as well as from its own reservoir. Thus, a total of over 1.2 billion cubic meters of water would flow to the "Karnobat" Dam, which needs 750 million cubic meters of water to operate. The wall of the dam would be 25-26 meters high (30 meters, if the section above the water level is included), 40 meters wide at the river bed, and 160 meters long at the top. The foundation at the site of the proposed dam is of volcanic rock (Tuphites). The artificial lake made by this dam would cover an area of about 70,000 decares.

The proposed canal would have enough water for all industrial enterprises along the entire route, for navigation, and for the irrigation of about 2 million decares of land.

The following ten pumping stations would be used for raising the water about 25 meters from the "Durzhava" [Kuza-Durzhava] Dam to the canal, for regulating the water level along the entire canal route, for providing water for the canal during the summer, and for irrigation:

Name of Station	Capacity (kw)	Needed Power (kw-hr)
Chernigrad	1,600	3,300,000
Krumovo gradishte	8,000	19,000,000
Turnava	1,600	3,000,000
Gulubintsi	2,000	5,500,000
Karnobat	2,000	4,000,000
Kaloyanovo	240	400,000
Tundzha	200	360,000
Korten	160	300,000
Stara Zagora	100	200,000
Svoboda	14,000	44,000,000
	30,100 [sic]	80,060,000

Approximately half of the total electric power would be used by the "Svoboda" Pumping Station near the "Durzhava" [Kuza-Durzhava] Dam. These pumping stations would operate chiefly with cheap nighttime current.

In addition to its important role in irrigation and water supply, the canal would contribute considerably to the development of water power; many hydroelectric power stations would be built near Burgas, which has a shortage of water power. The canal would reduce the expense of transmitting excess current over great distances and would aid in the rapid electrification of mines and industrial projects in this region. The following 16 electric power stations would operate along the main canal and its branches:

	Capacity (kw)	Output (kw-hr)
Aytos	15,000	53,200,000
Bulgarovo	13,500	47,600,000
Kameno I	2,000	7,200,000
Kameno II	2,000	7,200,000
Bratovo	1,500	5,500,000
Vinarsko	1,800	4,700,000
Sungulare	7,500	26,600,000
Binkos	4,400	18,100,000
Krumovo gradishte	2,000	6,100,000

	Capacity (kw)	Output (kw-hr)
Blatets	2,000	5,500,000
Tundzha	1,000	3,300,000
Korten	1,600	5,000,000
Stara Zagora	2,000	5,600,000
Zlatna livada	4,200	16,600,000
Yordanovo	1,200	5,300,000
Gorski izvor	1,200	5,500,000
Total	12,000 [sic]	223,000,000

An average annual output of 120 million kilowatt-hours of electric power would be produced chiefly for Burgas and vicinity by the Aytos, Bulgarovo, Kameno I and II, and Bratovo hydroelectric power stations.

The construction of one continuous canal from Burgas to Plovdiv and Maritsa-iztok, connecting the Black Sea and lakes Mandra and Vaya with the "Karnobat" and "Durzhava" [Kuza-Durzhava] dams, not only would assure cheap water supply for the industrial, mining, and steam-powered enterprises, but would also create a large lake covering an area of 130,000 decares, which would be used for fishing.

Capital investments for this project would be allocated as follows (in percent):

Irrigation, including the irrigation network	55.3
Water supply	3.6
Diversion of the Maritsa River from Dimitrovgrad to Maritsa	4.8
Power production	16.3
Fishing	0.8
Shipping	19.2
Total	100

Gross additional income from the projected system would be divided as follows (in percent):

From irrigation	69.5
From water supply	2.2
From diverting the Maritsa River	0.2
From power production	4.8

From fishing	7.3
From shipping	16.0
Total	100

The irrigation of 2 million decares of rich land by the proposed canal would transform the Thracian plain into one of the most fertile areas of Bulgaria. The canal would not affect the present irrigation and power-producing projects in this area, as the canal is geographically south of them.

The transformation of Plovdiv, Dimitrovgrad, Maritsa-iztok, Chirpan, Stara Zagora, Nova Zagora, Sliven, Karnobat, and Aytos into Black Sea ports would promote the industrialization of these centers and would facilitate cheap transportation, between these cities, of the following import and export items: building materials, cement, iron, machinery, sleepers and pillars, fertilizers, ores and minerals (rudni izkopaemi), coat and briquettes from the Maritsa basin, bricks, marble and concrete blocks, cereals, fruit, beets, raw textile fibers, and liquid fuels.

The canal would connect the main commercial, mining, and industrial centers of the Thracian plain with the port of Burgas, with the Soviet navigation network, and with the Danube, and barges and ships leaving Bulgarian interior ports would be able to sail directly to Soviet and Danube ports.

The writers suggest that a group of specialists from the Bulgarian Academy of Sciences, the "Stalin" State Polytechnic Institute, the Union of Scientific and Technical Societies, the State Planning Commission, the Ministry of Electrification, the Ministry of Agriculture, the Ministry of Heavy Industry, and the Administration of Water Transportation, and representatives of the Central Committee of the Bulgarian Communist Party be organized to conduct detailed research and to work out the technical plans for the proposed canal.(1)

Research studies are being conducted to determine the feasibility of constructing a reservoir at Kalugerovo, Pazardzhik, or Karnobatsko blato. Construction of the Pazardzhik-Burgas Canal, which would be used for irrigation, water power, and navigation, is planned. This canal, with a capacity of over one billion cubic meters of water, would irrigate the fields of southeastern Bulgaria and those along the canal route which are not reached by the "Topolnitsa," "Lesichevo," and "G. Dimitrov" dams. The canal will probably be constructed, if the studies on this project yield favorable results.(2)

[Map showing projected Pazardzhik-Burgas Canal, suggested by Engr M. Koychev and Rniskhi (fnu), scientific worker, is appended.]

SOURCES

1. Sofia, Tekhnika, No 5, 1953, article by Engr M. Koychev and Rniskhi (fnu), scientific worker

2. Sofia, Elektroenergia, Apr 53, article by Engr D. Dimitrov

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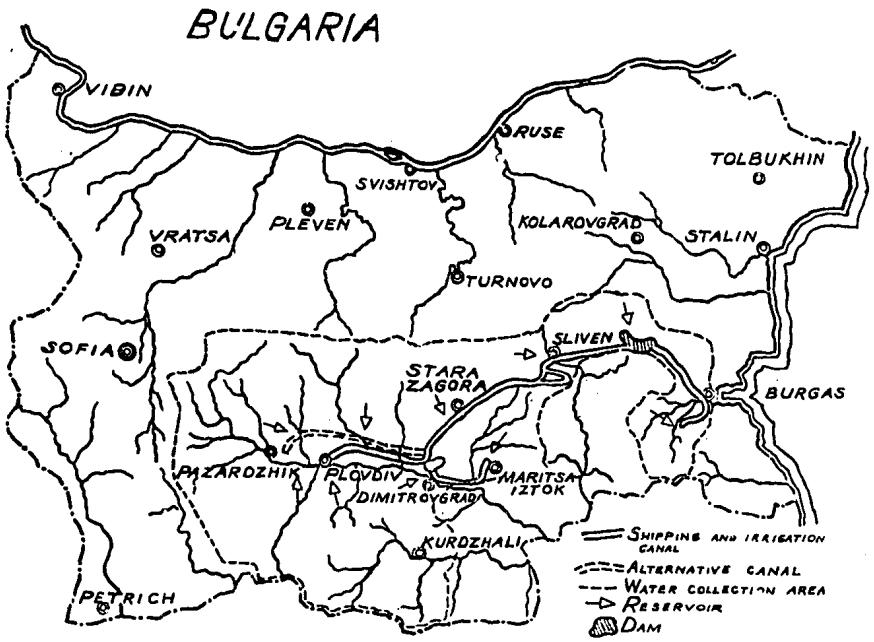

Projected Pazardzhik-Burgas Canal
(suggested by Lngr M. Koychev
and Rniskhi [fnu]), scientific worker)(1)

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